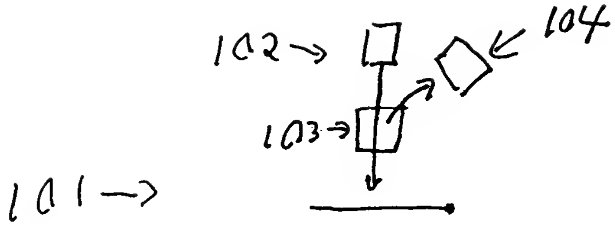


Figure 1

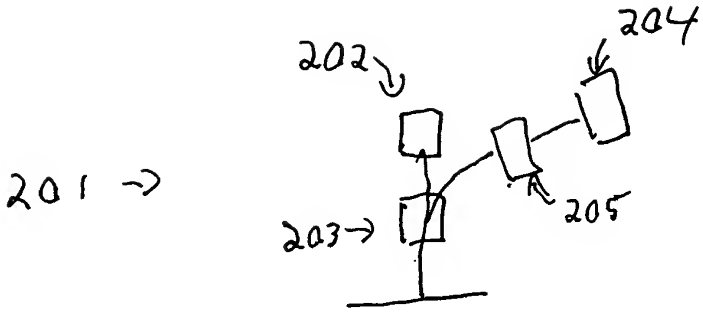


Figure 2

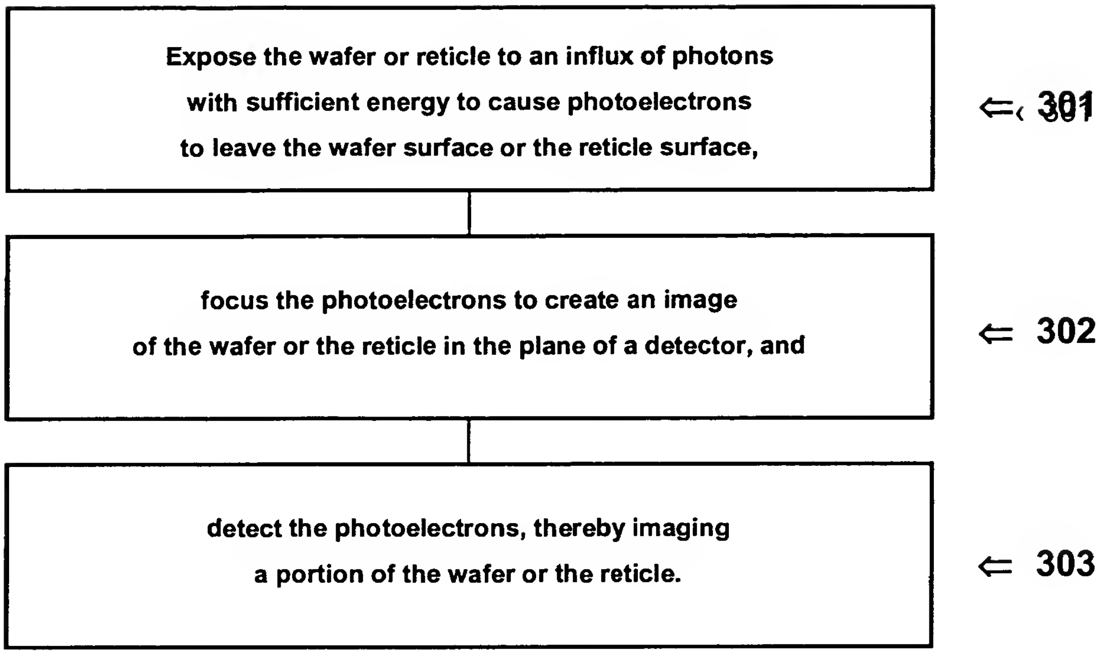

Expose the wafer or reticle to an influx of photons with sufficient energy to cause photoelectrons to leave the wafer surface or the reticle surface,
301
focus the photoelectrons to create an image of the wafer or the reticle in the plane of a detector, and
302
detect the photoelectrons, thereby imaging a portion of the wafer or the reticle.
303

Figure 3

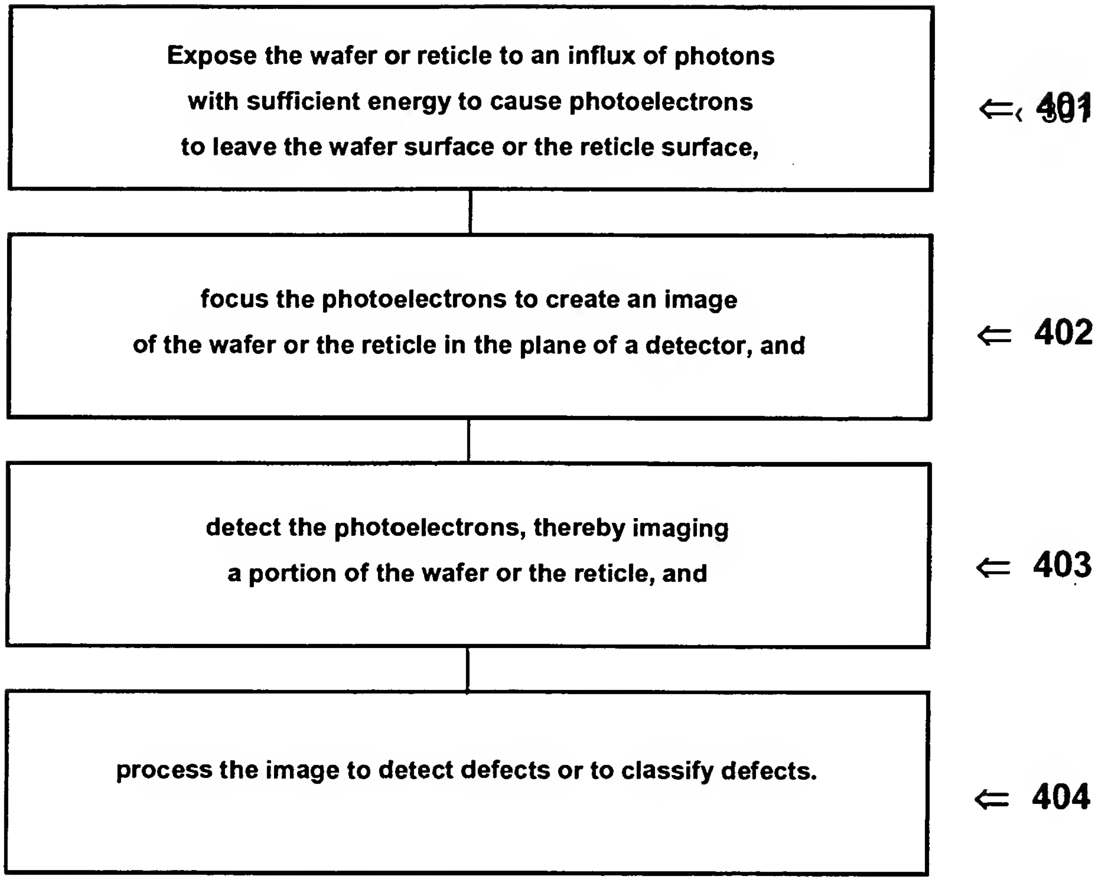

Expose the wafer or reticle to an influx of photons with sufficient energy to cause photoelectrons to leave the wafer surface or the reticle surface,
401
focus the photoelectrons to create an image of the wafer or the reticle in the plane of a detector, and
402
detect the photoelectrons, thereby imaging a portion of the wafer or the reticle, and
403
process the image to detect defects or to classify defects.
404

Figure 4

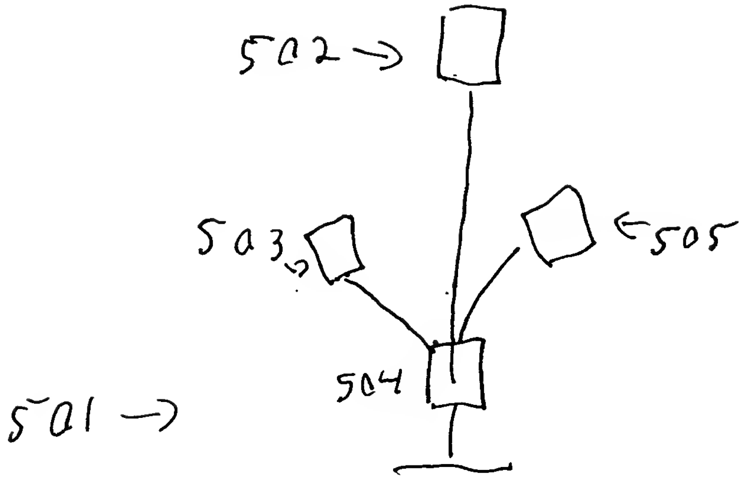


Figure 5

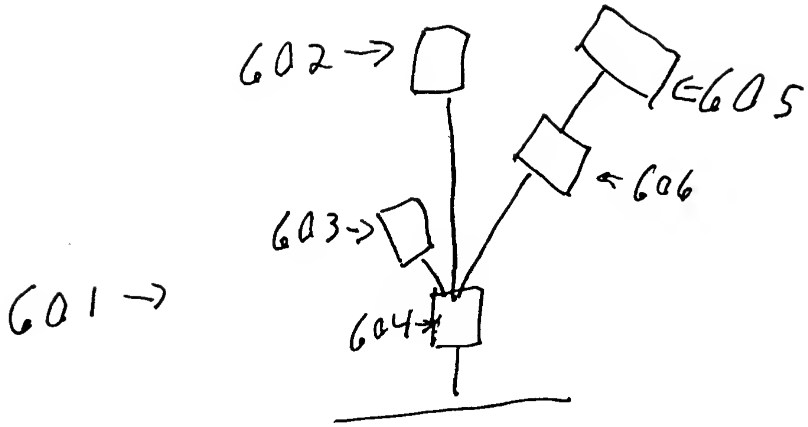


Figure 6

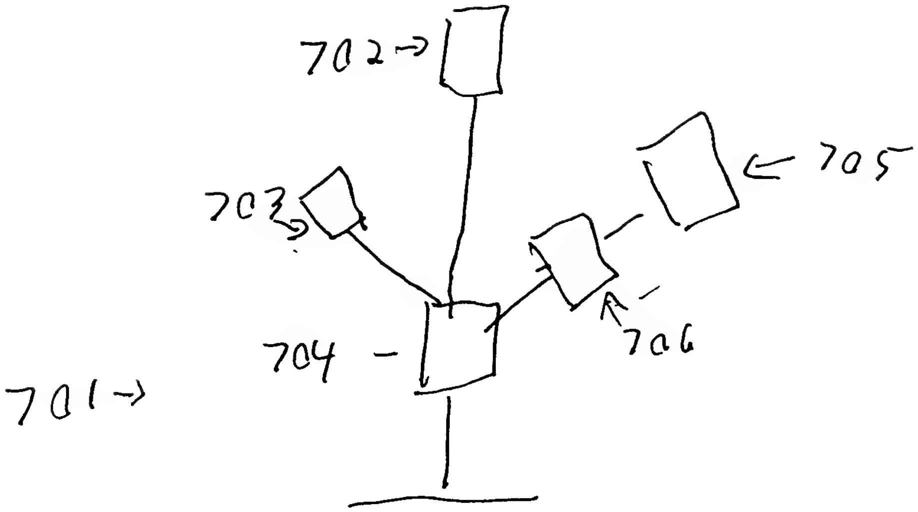


Figure 7

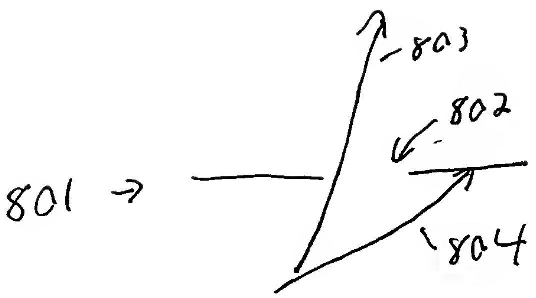


Figure 8

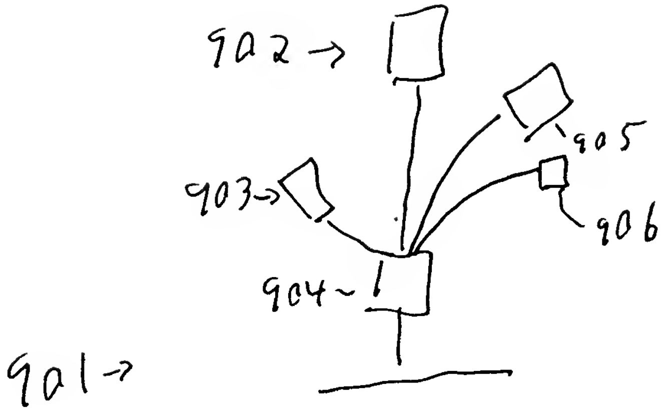


Figure 9

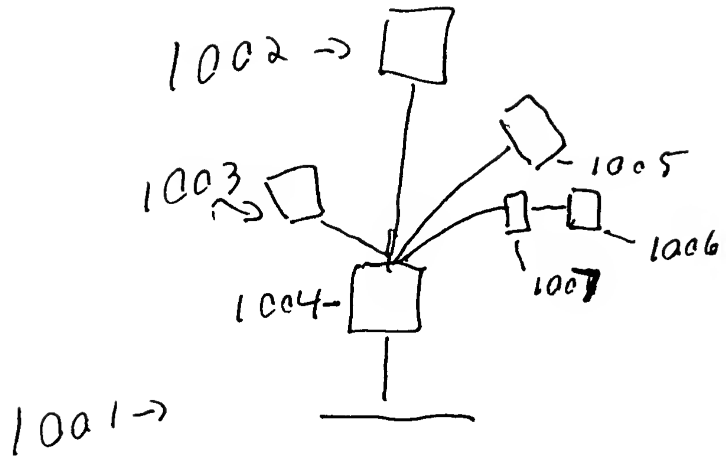


Figure 10

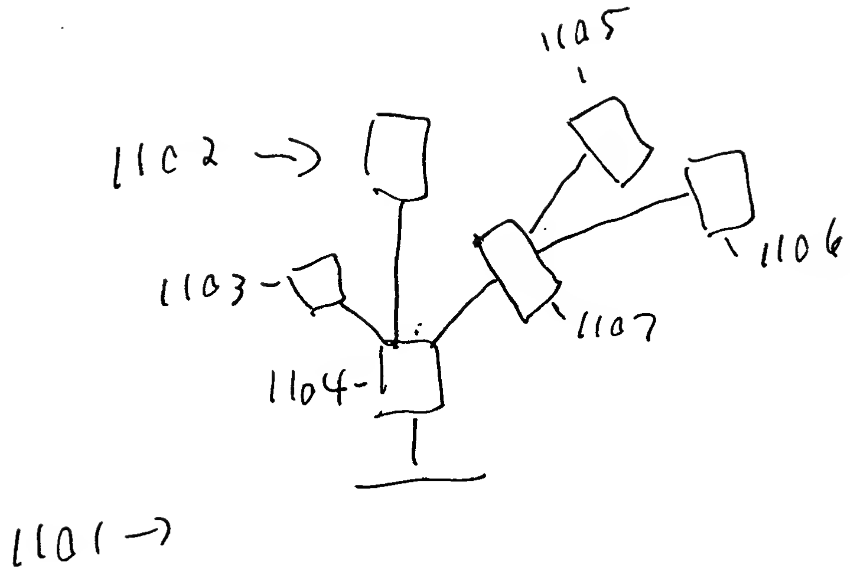


Figure 11

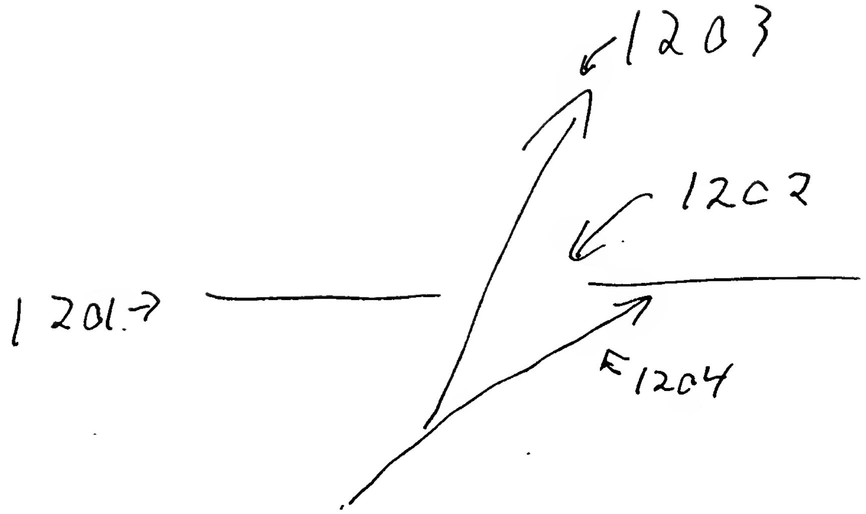
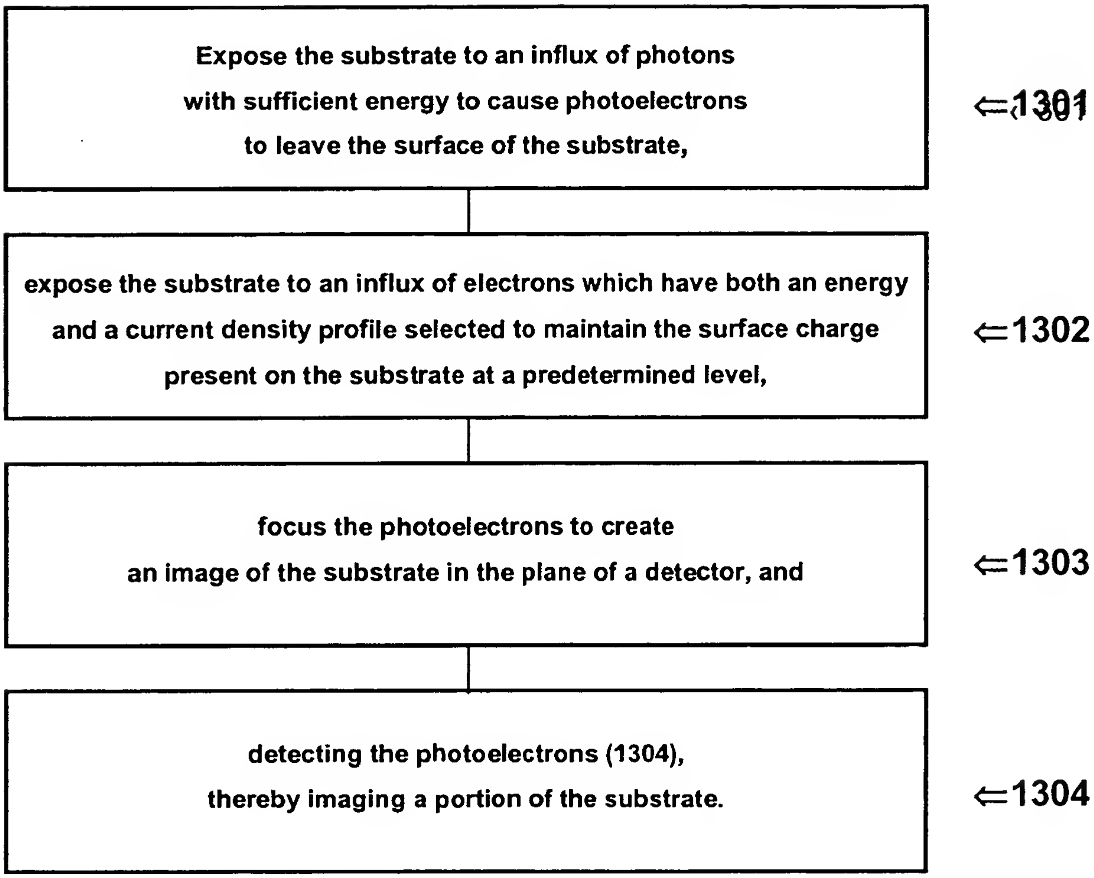


Figure 12



Expose the substrate to an influx of photons with sufficient energy to cause photoelectrons to leave the surface of the substrate,

expose the substrate to an influx of electrons which have both an energy and a current density profile selected to maintain the surface charge present on the substrate at a predetermined level,

focus the photoelectrons to create an image of the substrate in the plane of a detector, and

detecting the photoelectrons (1304), thereby imaging a portion of the substrate.

Figure 13

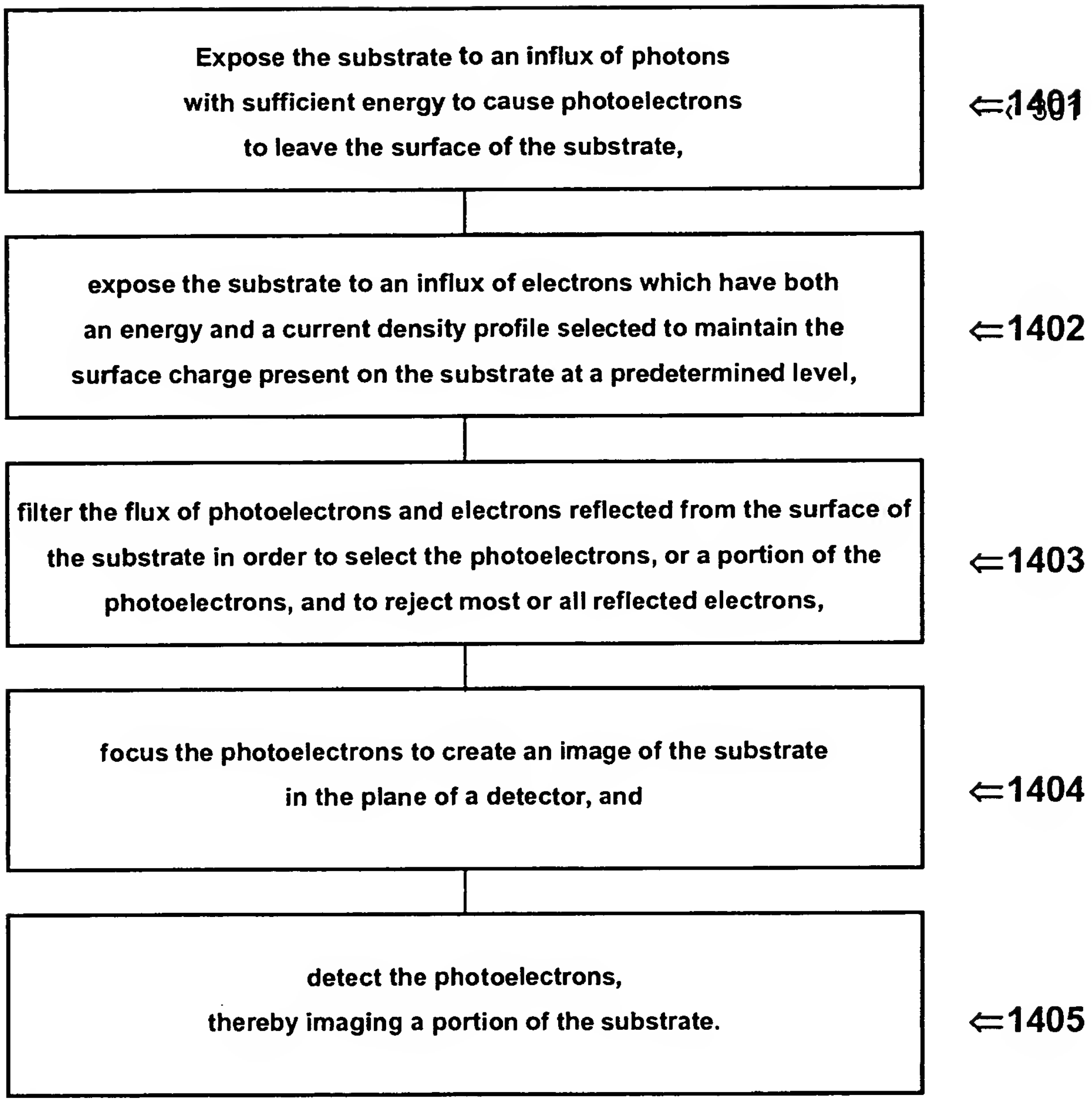

Expose the substrate to an influx of photons with sufficient energy to cause photoelectrons to leave the surface of the substrate,
1401
expose the substrate to an influx of electrons which have both an energy and a current density profile selected to maintain the surface charge present on the substrate at a predetermined level,
1402
filter the flux of photoelectrons and electrons reflected from the surface of the substrate in order to select the photoelectrons, or a portion of the photoelectrons, and to reject most or all reflected electrons,
1403
focus the photoelectrons to create an image of the substrate in the plane of a detector, and
1404
detect the photoelectrons, thereby imaging a portion of the substrate.
1405

Figure 14

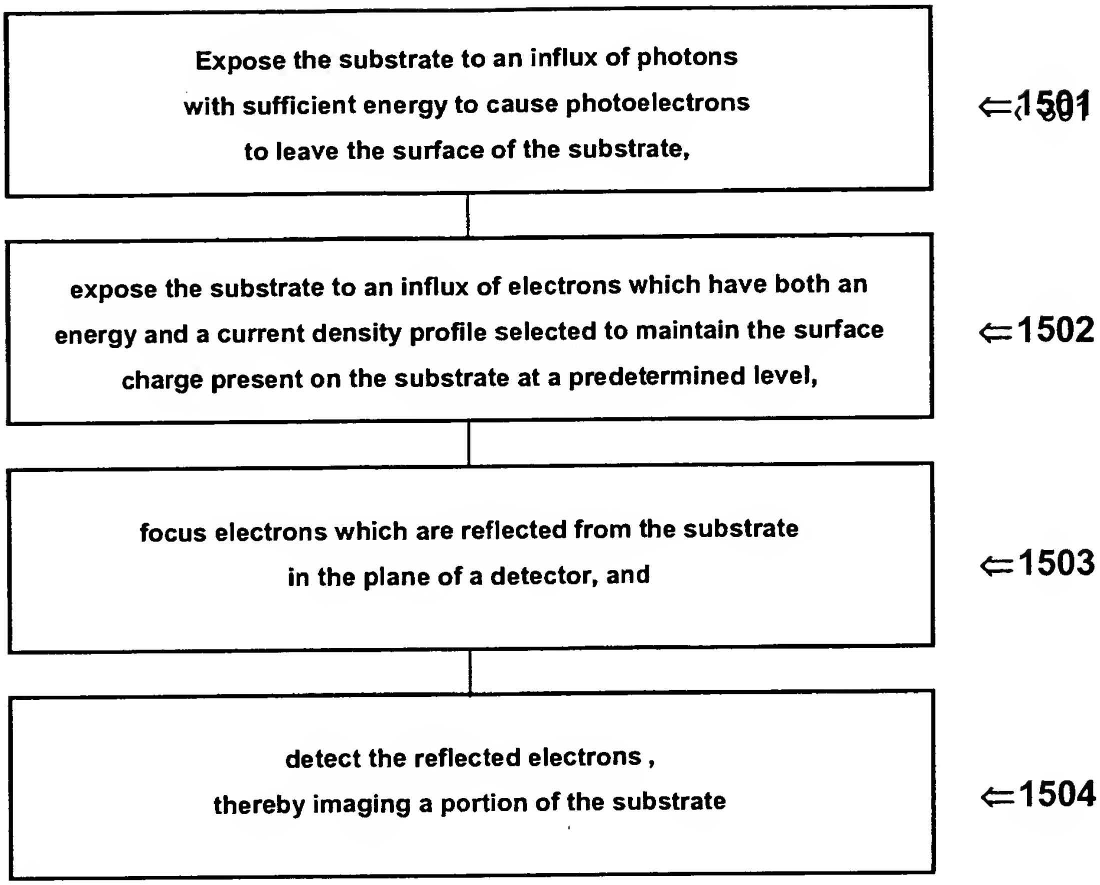

Expose the substrate to an influx of photons with sufficient energy to cause photoelectrons to leave the surface of the substrate,
⇐1501
expose the substrate to an influx of electrons which have both an energy and a current density profile selected to maintain the surface charge present on the substrate at a predetermined level,
⇐1502
focus electrons which are reflected from the substrate in the plane of a detector, and
⇐1503
detect the reflected electrons , thereby imaging a portion of the substrate
⇐1504

Figure 15

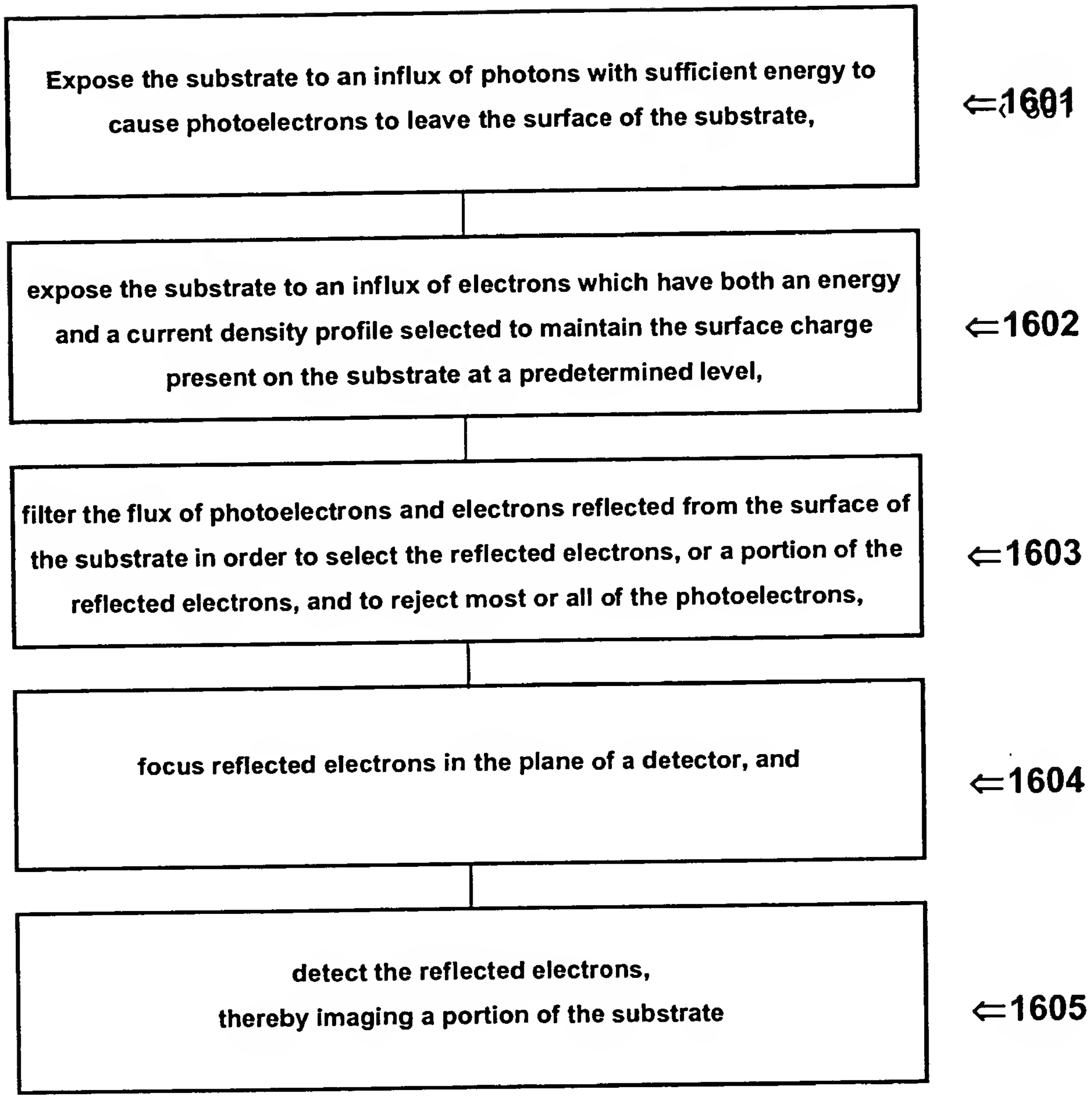

Expose the substrate to an influx of photons with sufficient energy to cause photoelectrons to leave the surface of the substrate,
⇐1601
expose the substrate to an influx of electrons which have both an energy and a current density profile selected to maintain the surface charge present on the substrate at a predetermined level,
⇐1602
filter the flux of photoelectrons and electrons reflected from the surface of the substrate in order to select the reflected electrons, or a portion of the reflected electrons, and to reject most or all of the photoelectrons,
⇐1603
focus reflected electrons in the plane of a detector, and
⇐1604
detect the reflected electrons, thereby imaging a portion of the substrate
⇐1605

Figure 16

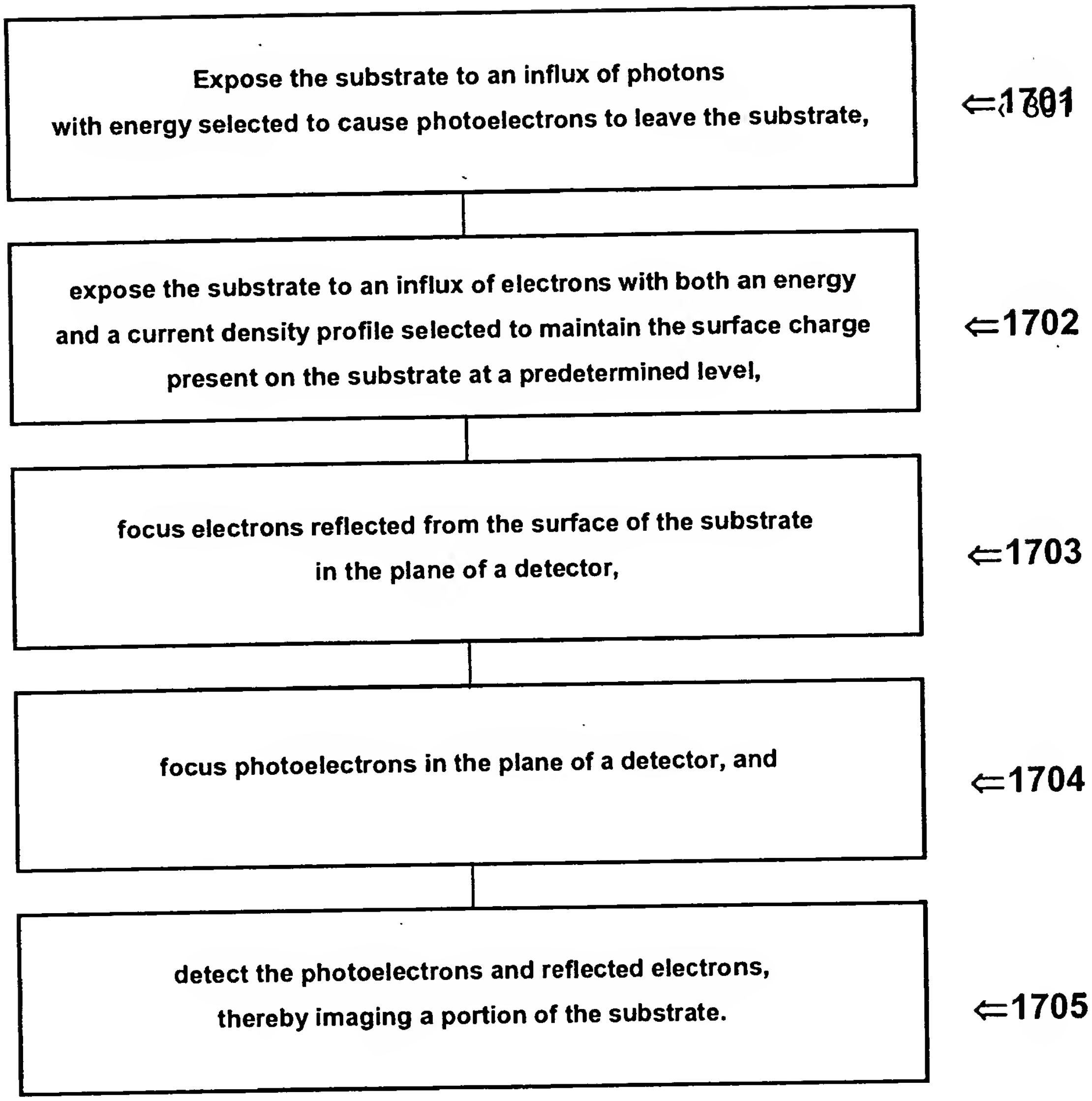

Expose the substrate to an influx of photons with energy selected to cause photoelectrons to leave the substrate,
⇐1701
expose the substrate to an influx of electrons with both an energy and a current density profile selected to maintain the surface charge present on the substrate at a predetermined level,
⇐1702
focus electrons reflected from the surface of the substrate in the plane of a detector,
⇐1703
focus photoelectrons in the plane of a detector, and
⇐1704
detect the photoelectrons and reflected electrons, thereby imaging a portion of the substrate.
⇐1705

Figure 17

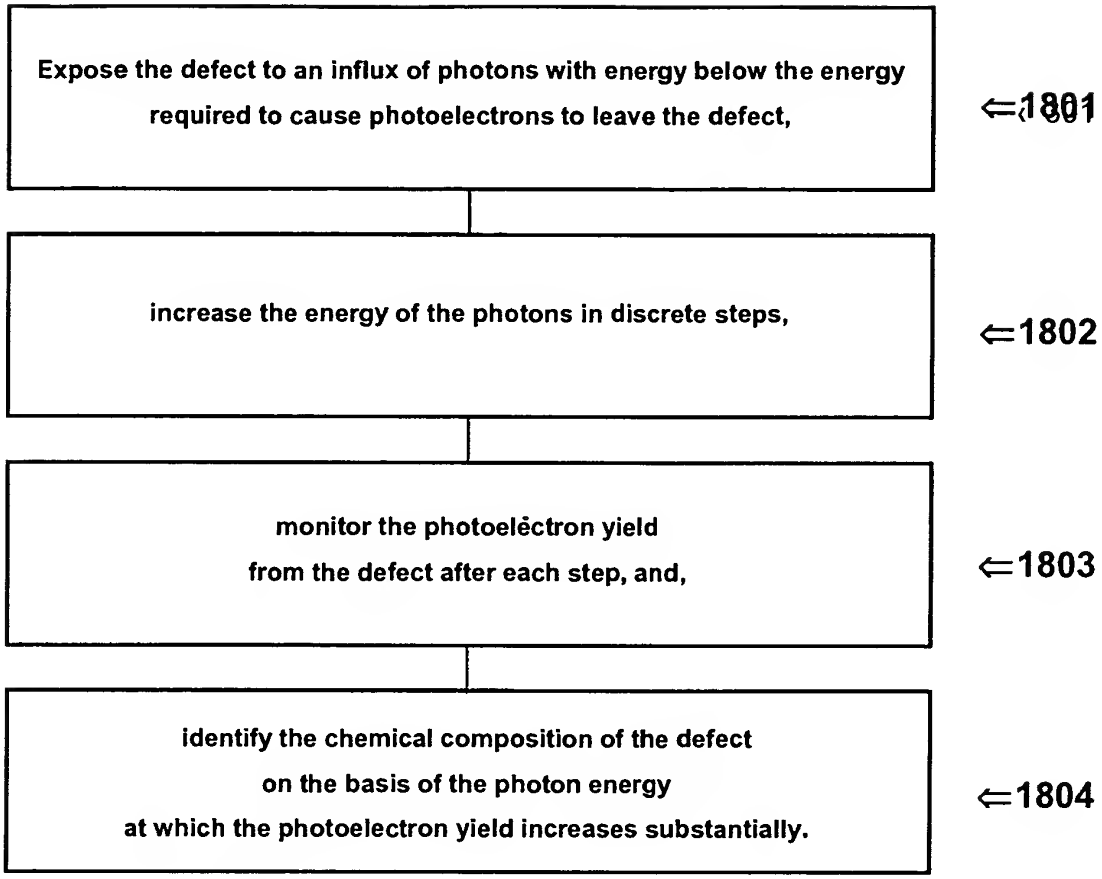

Expose the defect to an influx of photons with energy below the energy required to cause photoelectrons to leave the defect,
⇐1801
increase the energy of the photons in discrete steps,
⇐1802
monitor the photoelectron yield from the defect after each step, and,
⇐1803
identify the chemical composition of the defect on the basis of the photon energy at which the photoelectron yield increases substantially.
⇐1804

Figure 18

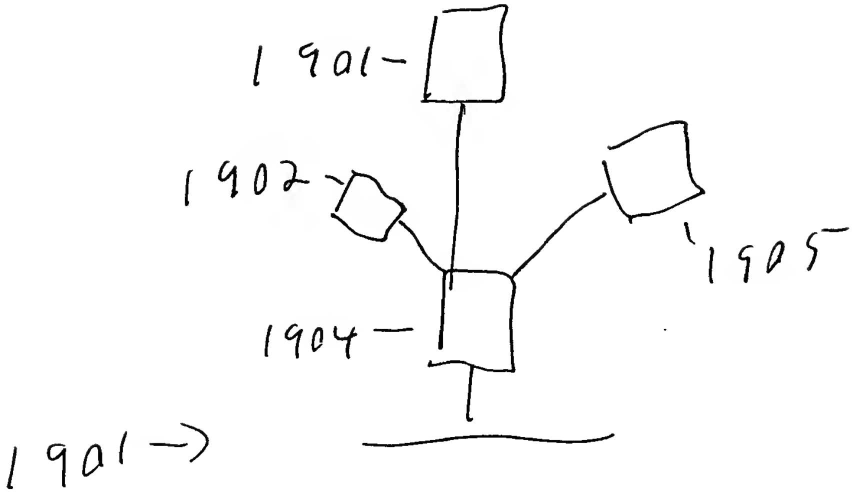


Figure 19

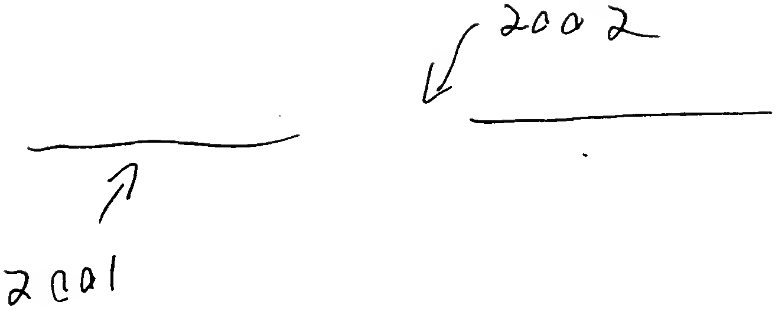


Figure 20

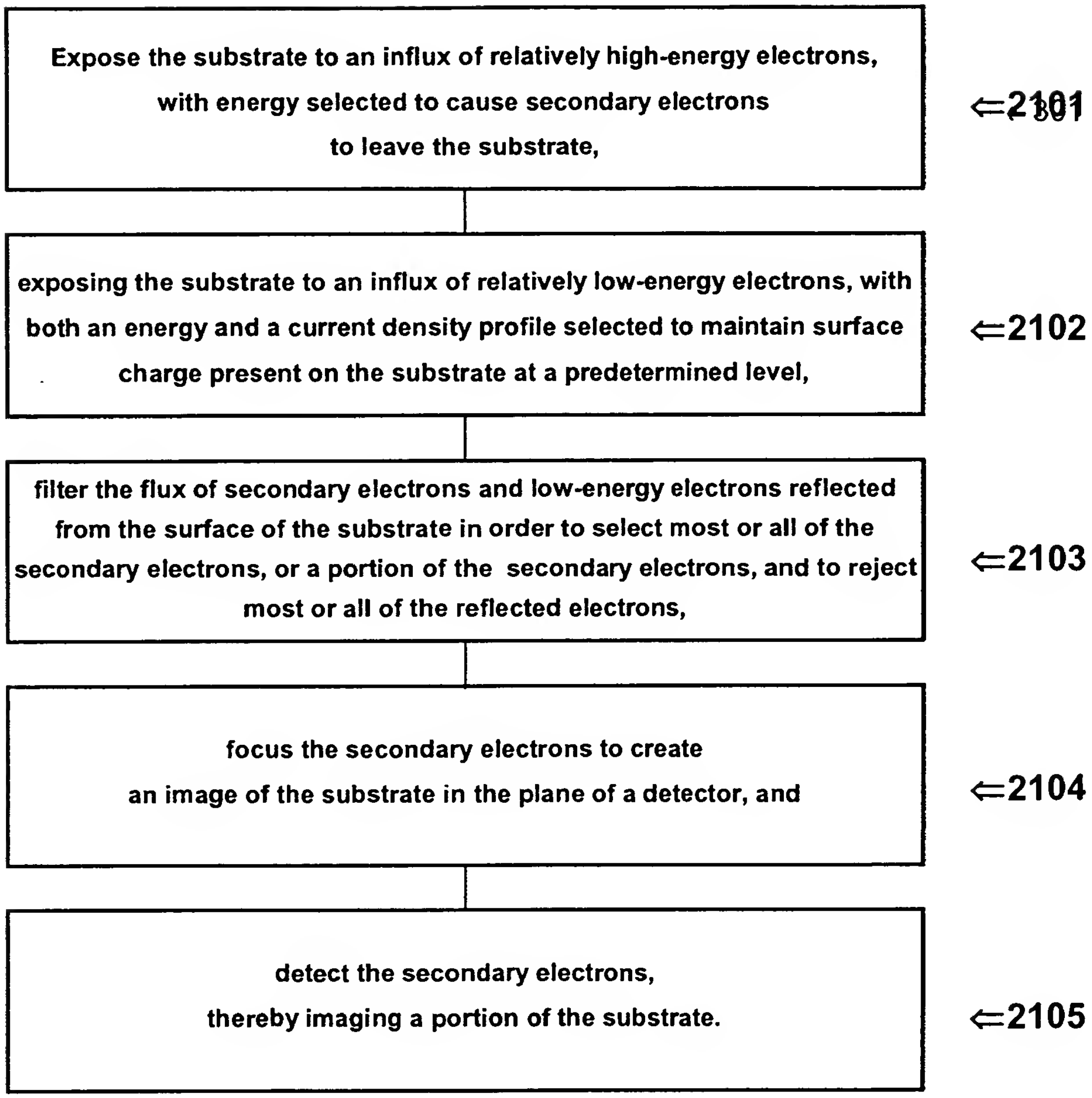

Expose the substrate to an influx of relatively high-energy electrons, with energy selected to cause secondary electrons to leave the substrate,
⇐2101
exposing the substrate to an influx of relatively low-energy electrons, with both an energy and a current density profile selected to maintain surface charge present on the substrate at a predetermined level,
⇐2102
filter the flux of secondary electrons and low-energy electrons reflected from the surface of the substrate in order to select most or all of the secondary electrons, or a portion of the secondary electrons, and to reject most or all of the reflected electrons,
⇐2103
focus the secondary electrons to create an image of the substrate in the plane of a detector, and
⇐2104
detect the secondary electrons, thereby imaging a portion of the substrate.
⇐2105

Figure 21

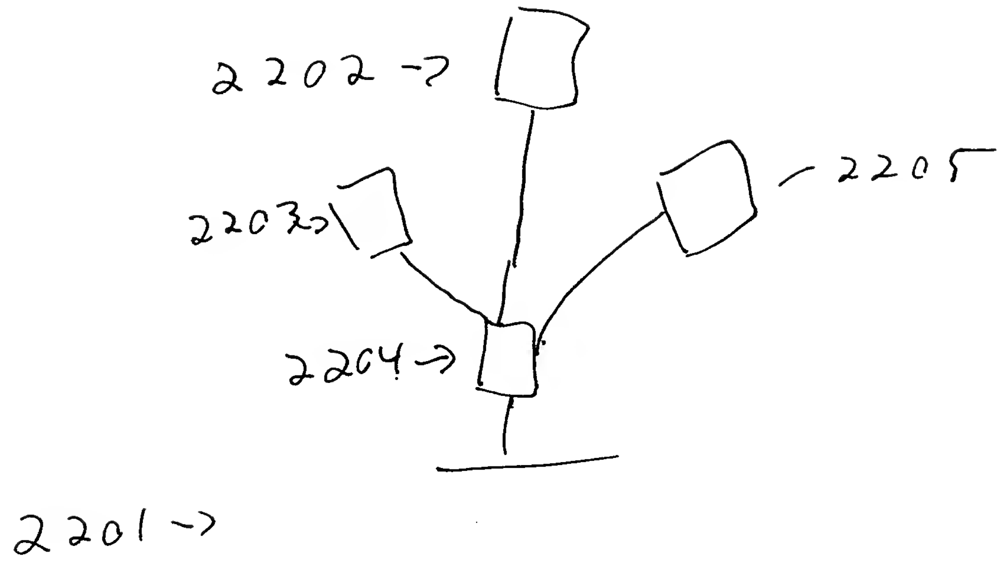


Figure 22

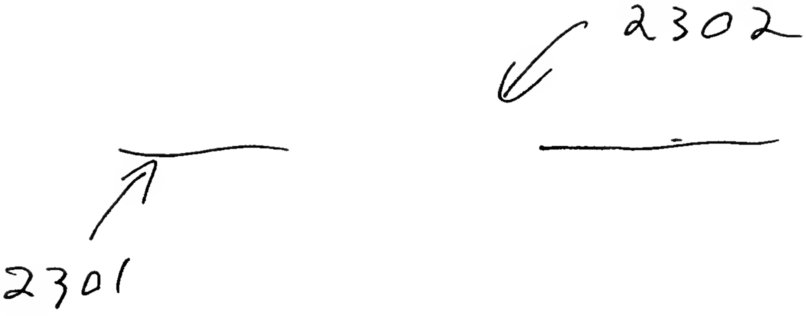
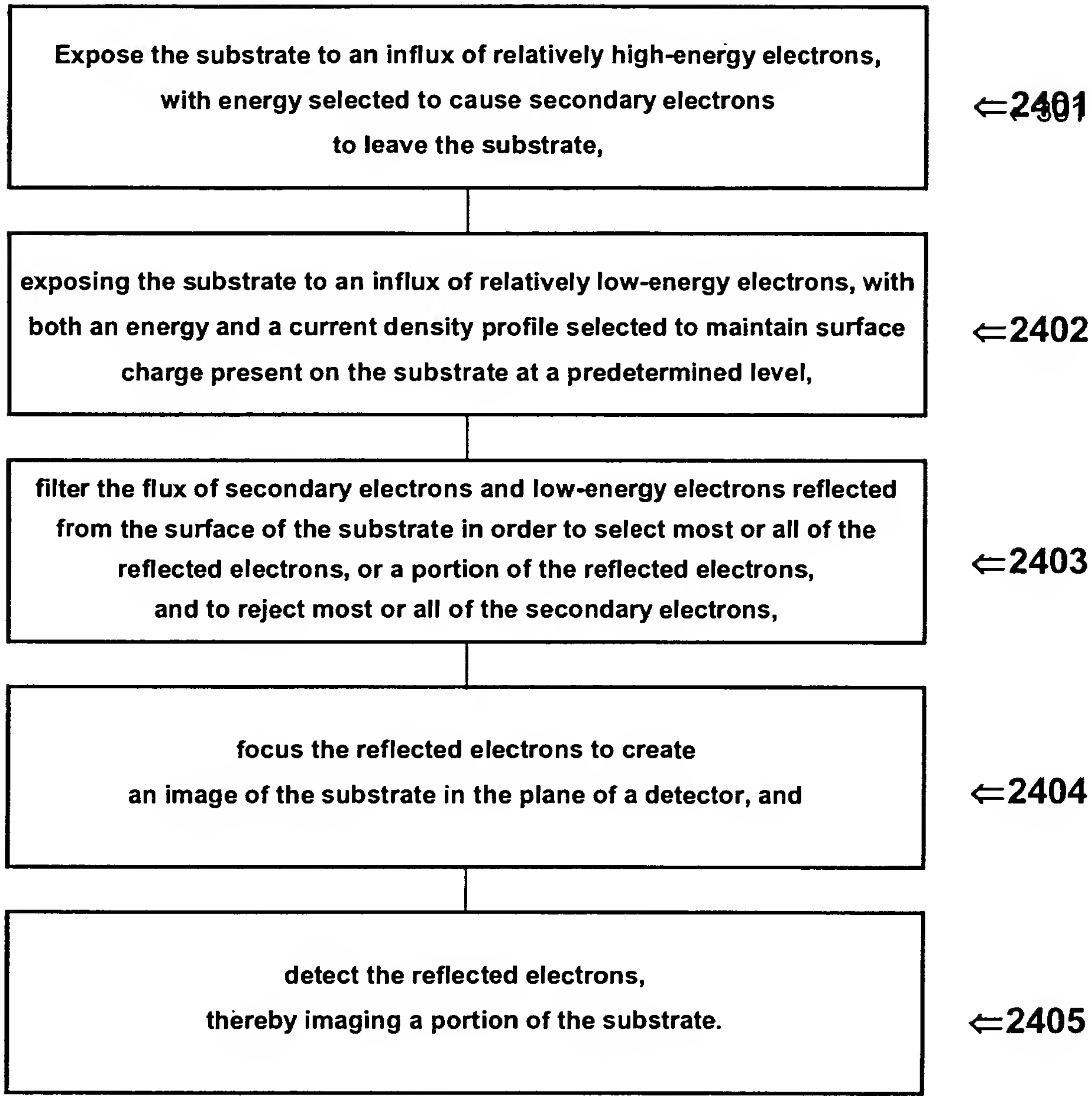


Figure 23


Expose the substrate to an influx of relatively high-energy electrons, with energy selected to cause secondary electrons to leave the substrate,

exposing the substrate to an influx of relatively low-energy electrons, with both an energy and a current density profile selected to maintain surface charge present on the substrate at a predetermined level,

filter the flux of secondary electrons and low-energy electrons reflected from the surface of the substrate in order to select most or all of the reflected electrons, or a portion of the reflected electrons, and to reject most or all of the secondary electrons,

focus the reflected electrons to create an image of the substrate in the plane of a detector, and

detect the reflected electrons, thereby imaging a portion of the substrate.

Figure 24

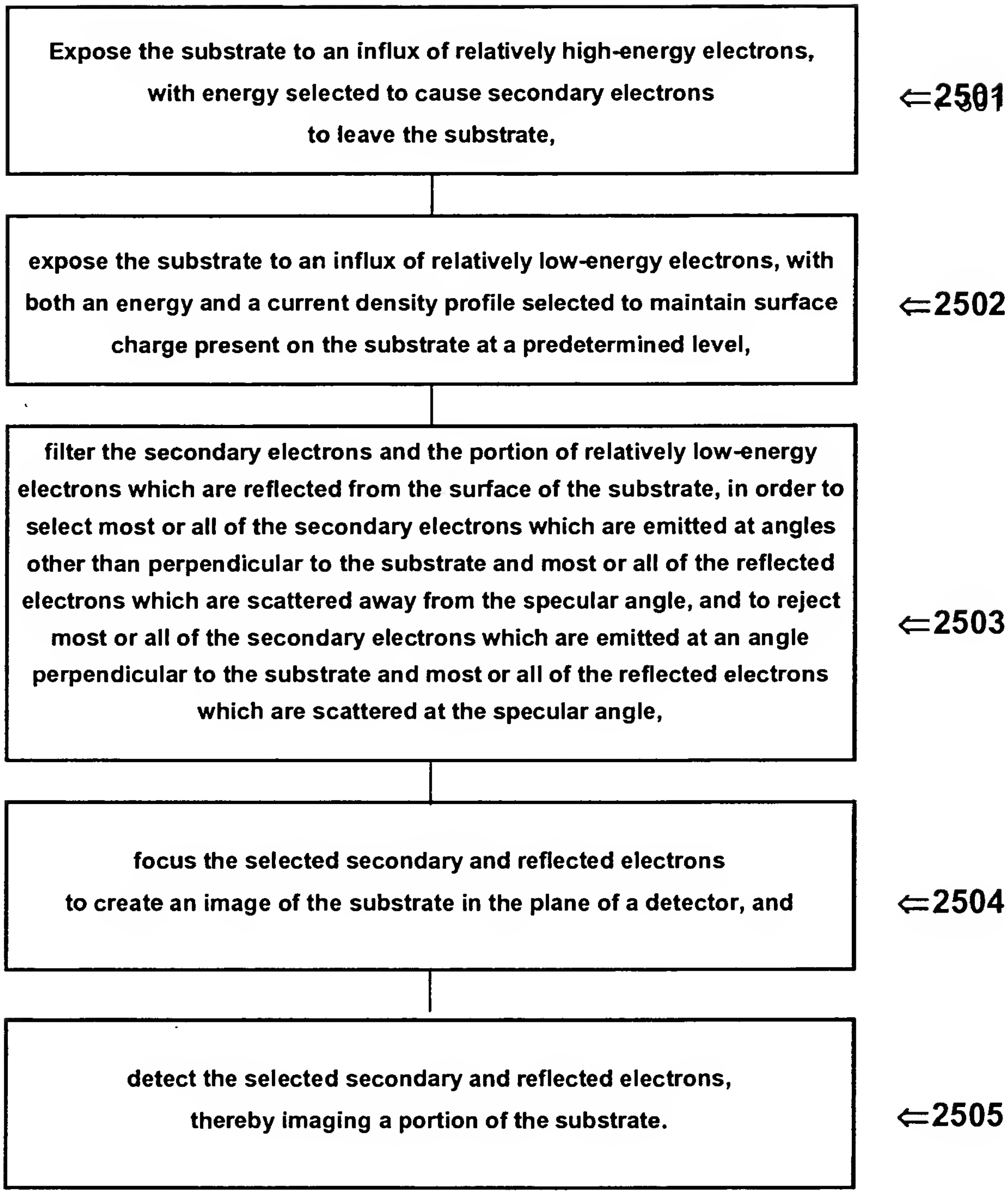

Expose the substrate to an influx of relatively high-energy electrons, with energy selected to cause secondary electrons to leave the substrate,
⇐2501
expose the substrate to an influx of relatively low-energy electrons, with both an energy and a current density profile selected to maintain surface charge present on the substrate at a predetermined level,
⇐2502
filter the secondary electrons and the portion of relatively low-energy electrons which are reflected from the surface of the substrate, in order to select most or all of the secondary electrons which are emitted at angles other than perpendicular to the substrate and most or all of the reflected electrons which are scattered away from the specular angle, and to reject most or all of the secondary electrons which are emitted at an angle perpendicular to the substrate and most or all of the reflected electrons which are scattered at the specular angle,
⇐2503
focus the selected secondary and reflected electrons to create an image of the substrate in the plane of a detector, and
⇐2504
detect the selected secondary and reflected electrons, thereby imaging a portion of the substrate.
⇐2505

Figure 25